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CURRENT TOPICS

Multiplex Radio Transmission.—A system of multiplex radio transmission has been perfected by Dr. Edwin H. Armstrong, professor of Electrical Engineering at Columbia University, and John H. Bose, of Columbia's Marcellus Hartley Research Laboratories. This system, which enables FM broadcasting stations to transmit simultaneously two or more different programs, is the most recent development based on principles which were described by Dr. Armstrong in 1935. The new development, however, employs a number of improvements created since World War II. The result, according to Dr. Armstrong, will be to double, at least, the effective function of the FM transmitter, "with obvious far-reaching effects on the methods of broadcasting radio communications of all kinds."

Several new types of service are made possible by this new system. An FM station, for example, can transmit a musical program on one channel, and send out on a second channel a voice program such as a speech, news bulletins or an advertising program; or it can transmit a single program stereophonically on the two channels. It can also act to transmit two independent musical programs so as to relay along a program to another station which it itself is not carrying on the main channel. All of these methods of operation have been successfully tested at Dr. Armstrong's Alpine FM transmitter, KE2XCC, at Alpine, N. J. Dr. Armstrong added that, of course, the system would not be limited to two channels only.

The present-day FM set is quite unaffected by the presence of the second channel, Dr. Armstrong said. Listeners on present-day FM sets, in fact, are unaware that there is a second program from Alpine that they are missing. Such two-channel transmissions have passed unnoticed for several years from the Alpine station. In order to receive the second channel, a modified form of FM receiver will be necessary, but the number of additional parts required will not unduly increase the cost of the set.

While multiplex operation of FM in the communications field has been in practical use for some years, its use in broadcasting presented problems not important in the communications field. These problems have been studied and successfully disposed of in several years of quiet work in the Marcellus Hartley Research Laboratories at Columbia and in experimental tests at the Alpine transmitter, with the result that the system has been brought to a practical entity, according to Dr. Armstrong. The credit for the engineering of the system, he said, belongs to Mr. Rose who, with Perry Osborn, chief engineer of the Alpine station, directed the experimental work.

He added that the real significance of the new system is that FM will prevail as the final aural system. It would be completely impossible to multiplex on any AM system, either on the standard band, or on a very high frequency (v.h.f.) band of the same frequency as the FM stations, and a station operator who can sell time on two channels obviously will outsell eventually the station operator with only one. The cost of equipping a transmitter for multiplex operation is not high. Transmitters already equipped with Serrasoid modulators which are employed in the new system are most readily susceptible to change, he said. Receiver prices will doubtless follow the course they have always taken since the superheterodyne receiver was introduced, producing a set ultimately fitting the capabilities of everyone's pocket-book.

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bringing rock fill to the various levels of the mine. Control chutes have been installed in the raise for handling the gravel at each station. Cement is brought from surface by the mine's regular transportation system.

Located in large rooms which provide ample space for cement storage, the mixers can produce a 16-cu. ft. batch of concrete every three minutes. It is poured into the placer, a cylinder 2½ ft. in diameter by 10 ft. long, into which compressed air is then introduced from the mine's main air line.

From the placer the "air-borne" concrete is blown through a line of 6-in. steel pipe which carries it along levels, up or down manways, and through twists and turns of the mine's workings until finally, perhaps a quarter of a mile or more from the mixing station, it drops right into the forms at the construction site.

At 90-deg. turns in the line T-bends are used; an air cushion which forms in the dead end of the T greatly reduces abrasion from the concrete. On long curves sections of 8-in. pipe are inserted, with Ni-Hard liners; standard steel elbows last as little as two hours under the impact of the concrete at these turns but the Ni-Hard liners, made of a very tough nickel alloy, were unchanged after six months of operation.

The men operating the concrete placers take pride in the astonishing performances racked up to date. Best "up" delivery so far was a total of 1,315 feet from the 20 level placer, consisting of 875 ft. on 20 level, up 210 ft. on a 47-deg. incline, 100 ft. on the level, up 50 ft. at 90 deg., and finally 80 ft. on the level. The 6 level station takes credit for the longest "down" delivery to date, a total of 1670 ft. from the placer into the forms for a new slusher station on 14 level.

Miniature Motor for Use in Bombers.—A miniature direct-current motor, probably the smallest ever built by General Electric, is currently being produced by the company's Specialty Motor Sub-Department for use in defense systems of the most advanced operational bombers.

About the size of an ordinary ink bottle—1⅝ in. in diameter and 2⅜ in. long—the tiny motor weighs approximately eight ounces. Rated at two-thousandths (0.002) horsepower at a speed of 6500 rpm., it is so sensitive that it is controlled by the output of two small vacuum tubes.

Of the split-shunt, reversible-rotation type, drawing maximum armature currents of 0.8 ampere from a 28-volt line, the "Tom Thumb drive" is required to withstand a high potential of 1500-volts above the ground. It is capable of responding to field currents of 0.00075 amps.

The small motor is designed to be at home at sea-level atmospheres or at altitudes as much as 50,000 ft., and in temperatures as low as −65 F. It is unaffected by dry, hot, or humid environmental conditions, according to G–E engineers.

Planes and Oil Aid Weed Control.—When Orville and Wilbur Wright ushered in the age of powered flight 50 years ago, they probably didn't dream of the multitudes of uses to which Americans would put airplanes. An important use is the control of weeds by means of airborne sprays. Not only farms, ranches and home gardens benefit from the spraying, but airports, oil installations and railroad rights-of-way are kept free of mesquite, poison ivy, poison oak, barberry and brambles. Oil, a partner in these operations, serves both as fuel for the planes and in the form of petro-chemicals in the sprays.

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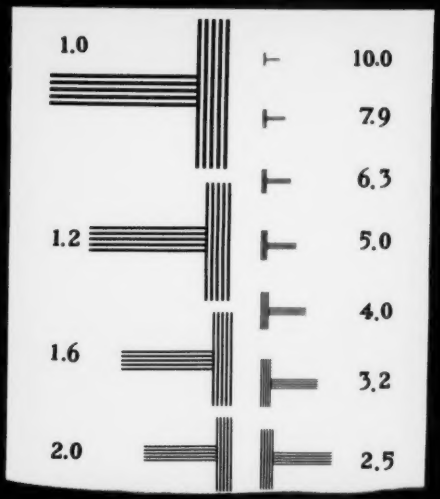

100 MILLIMETERS

INSTRUCTIONS Resolution is expressed in terms of the lines per millimeter recorded by a particular film under specified conditions. Numerals in chart indicate the number of lines per millimeter in adjacent "T-shaped" groupings.

In microfilming, it is necessary to determine the reduction ratio and multiply the number of lines in the chart by this value to find the number of lines recorded by the film. As an aid in determining the reduction ratio, the line above is 100 millimeters in length. Measuring this line in the film image and dividing the length into 100 gives the reduction ratio. Example: the line is 20 mm. long in the film image, and $100/20 = 5$.

Examine "T-shaped" line groupings in the film with microscope, and note the number adjacent to finest lines recorded sharply and distinctly. Multiply this number by the reduction factor to obtain resolving power in lines per millimeter. Example: 7.9 group of lines is clearly recorded while lines in the 10.0 group are not distinctly separated. Reduction ratio is 5, and $7.9 \times 5 = 39.5$ lines per millimeter recorded satisfactorily. $10.0 \times 5 = 50$ lines per millimeter which are not recorded satisfactorily. Under the particular conditions, maximum resolution is between 39.5 and 50 lines per millimeter.

Resolution, as measured on the film, is a test of the entire photographic system, including lens, exposure, processing, and other factors. These rarely utilize maximum resolution of the film. Vibrations during exposure, lack of critical focus, and exposures yielding very dense negatives are to be avoided.